Continued Development of the Gulf of Mexico Coastal Ocean Observing System

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
SEP 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Continued Development of the Gulf of Mexico Coastal Ocean Observing System	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Texas A&M University,Department of Oceanography,3146 TAMU,College Station,TX,77843-3146**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**11**	

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Award Number: *NA11NOS01220024*
http://www.gcoos.org

LONG-TERM GOALS

The overarching goal of this project is to build a robust, user-driven, sustained, operational Gulf of Mexico Coastal Ocean Observing System (GCOOS). The specific goals of this project are to maintain the existing GCOOS capabilities and, as funding allows, to augment the existing observations to fill gaps and provide enhanced products and services. GCOOS capabilities include components to integrate data sets from diverse providers; assure consistency, quality, and accuracy of the data; create new products needed by users; and provide in a timely and efficient manner the data, products, and services needed by decision-makers, diverse stakeholders, and the public. Physical, meteorological, biogeochemical, and bathymetrical data are major components of the data system.

OBJECTIVES

The goal will be achieved through accomplishment of six scientific or technological *objectives*:

Objective 1 is to maintain and strengthen the GCOOS Regional Association (GCOOS-RA) through continuing the activities of the board, councils, committees, task teams, and office staff to manage the development of the GCOOS and by working with regional stakeholder groups to identify their various needs and to guide the GCOOS priorities.

Objective 2 is to continue to build the observing system, GCOOS, through integration of existing observations made by different entities, provision of operation and maintenance support for existing non-federal systems that (a) monitor surface currents, harmful algal blooms, hypoxia, water level changes, estuarine water quality, and ecosystem health, (b) derive products needed by users from satellite data, and (c) add new observations to fill gaps as funding allows.

Objective 3 is to improve the Data Management and Communications (DMAC) system by enhancing and expanding the capabilities of the GCOOS Data and Products Portal; adding new data providers for Gulf open ocean, coastal, and estuarine regions and making their data interoperable; building capabilities to access legacy data; and strengthening the regional involvement with the evolution of and compliance with the data management and communication plans of IOOS.

Objective 4 is to support regional modeling capacity through providing *in situ* and remotely-sensed data to meet the needs of the modeling community in machine-to-machine formats, establishing a regional modeling task team for the Gulf of Mexico, and pursuing ecosystem modeling pilot projects to support marine resource decision-makers.

Objective 5 is to enhance the integrated outreach and education activities of the GCOOS-RA, through the activities of the GCOOS Education and Outreach Coordinator and the Education and Outreach Council, that improve information exchange between user groups and data providers, promote ocean literacy, and provide materials for the public, such as interactive ocean-themed kiosk exhibits.

Objective 6 is to obtain certification to become a member of U.S. Integrated Ocean Observing System (IOOS) when the process is established.

APPROACH AND WORK PLAN

1. ***Scientific/technical approach***: Our approach consists of three activities under this project: maintain the base capabilities, contribute support to keep existing non-federal observing systems functional, and add new observing systems to fill gaps.

Maintain Base Capabilities: The first activity for this work plan is to maintain the base capabilities of the GCOOS-RA that have evolved over the past 10 years. The base capabilities are to (1) maintain the GCOOS-RA so it can continue to build toward a comprehensive GCOOS; (2) continue DMAC-

compliant activities to achieve interoperability with non-federal data providers—our local data nodes; (3) maintain the functioning of the Data and Products Portal; and (4) continue activities with the outreach and education community to enhance public knowledge of the oceanic environment, their impacts on it, and its impacts on them.

Keep Existing Systems Functional: The second activity under the work plan is to (1) assist with keeping key existing non-federal observational systems functional by contributing support for operations and maintenance (O&M), (2) add enhancements to the Data Portal, and (3) initiate an ecosystem modeling pilot activity to benefit state decision-makers.

Add New Systems: Achieving a comprehensive observing system for the Gulf of Mexico—the GCOOS—requires the addition of new observing assets to fill gaps in needed observations. For year one of the project, no new observing systems will be added because the funding level is not sufficient to install, operate, and maintain new observing assets.

2. ***Key Personnel***: The key individuals on this project are identified in Table 1, together with their affiliations and roles in the project. These are project principal investigators and co-principal investigators, including several whose tasks do not begin until the coming year. Additionally, the volunteers who make up the GCOOS-RA Board of Directors (http://gcoos.tamu.edu/board-members.html) or serve on the GCOOS committees, councils, and task teams ((http://gcoos.tamu.edu/councils.html) are key people that provide guidance and direction to the office staff, but they vary and are not included here.

3. ***Work Plan for Upcoming Year***: The work plan for the upcoming year includes five tasks. The office staff will organize and hold meetings of the GCOOS-RA governing bodies and stakeholder workshops. The project team will operate their local data nodes and provide data and products to the GCOOS data system. The project team and other members of the GCOOS-RA will engage with stakeholder sectors to ascertain needs. The office staff will entrain additional non-federal local data nodes into the GCOOS data system as well as enhance the Data-Product Portal's capabilities and products. The office staff and other GCOOS-RA members will continue working with the outreach and education community to put information into the hands of those who need it. Plans for year 2 include the addition of new assets to the systems of the principal investigators, again, only if funding for year two is sufficient.

WORK COMPLETED

U.S. IOOS regional awards were finalized by NOAA in late August 2011, so work under this award is just beginning. The 14 subawards for work in year 1 are being prepared and executed.

RESULTS

U.S. IOOS regional awards were finalized by NOAA in late August 2011, and work under this award is just beginning. So, there are no results to report at this time.

Table 1. Key Personnel and Project Roles by GCOOS Subsystem

Key Investigator	Institution	Project Role	Base Activity Year 1	Upcoming Year = Base + Enhancements
Coordinated Regional Management and Governance Subsystem				
Ann E. Jochens	TAMU	PI, Program Manager, and Executive Director of the GCOOS-RA	Staff & Fiscal Oversight, Meetings & Travel to Maintain Regional Association	Improved Interactions with Key Stakeholder Sectors; Hold Stakeholder Workshops; Enhanced Committee Work; More Travel Interactions
Data Management and Communications (DMAC) Subsystem				
Matthew K. Howard	TAMU	Co-PI, GCOOS Data Manager	Maintain Basic DMAC Capability & Data Portal Maintain TABS local data node	Maintain THREDDS and raster programming capability beyond December 2011
Felimon Gayanilo	UM	Co-PI, GCOOS Data Portal System Architect	Programming	DMAC programming assistance for new local data nodes
Sara Graves	UAH	Co-PI	*No activity in Year 1*	Enhancements to GCOOS Data Module
Clint Padgett	Bowhead/ACOE	Co-PI	*No activity in Year 1*	Enhancements to GCOOS Data Module
Observing Subsystem				
Mark Luther Steve Meyers[1]	USF	Co-PIs; COMPS Local Data Node	Maintain COMPS local data node on west Florida shelf	Contributions to DMAC evolution and improved data streaming
Stephan Howden	USM	Co-PI; CenGOOS Local Data Node and Stations	Maintain USM local data node; provide O&M for HFR/buoy in Central Gulf	O&M support for glider operations
Eric Milbrant[2] Alex Rybak	SCCF	Co-PIs; SCCF Local Data Node	Maintain the SCCF local data node in Southwest Florida	Double the data provided
Mike Dardeau	DISL	Co-PI; Mobile Bay Stations	*No activity in Year 1*	Support for O&M for 3 stations in Mobile Bay
Lei Hu	DISL	Co-PI; Mobile Bay Local Data Node	Maintain local data node at Mobile Bay	Maintain local data node at Mobile Bay
Kyeong Park	DISL	Co-PI; New Provider	*No activity in Year 1*	Telemetry for existing buoy; O&M for new data provider
Chunyan Li[3]	LSU	Co-PI; WAVCIS Stations & Local Data Node	Maintain WAVCIS local data node in eastern Louisiana; O&M to keep at least one WAVCIS station operational	O&M to keep additional WAVCIS stations operational
Lisa Campbell	TAMU	Co-PI; HAB Local Data Node	*No activity in Year 1*	Maintain data node – phytoplankton/HABs at Port Aransas, Texas
Kevin Speer	FSU	Co-PI; New Provider	New data provider; Big Bend area off Florida	O&M to keep Big Bend FL - Tower N7
Gary Kirkpatrick	MOTE	Co-PI; HAB Stations & Local Data Node	Maintain Mote local data node & O&M to keep 2 HAB buoys operational	O&M for additional Mote HAB obs
Robert Currier	MOTE	Co-PI; New Provider	*No activity in Year 1*	new data provider—beach quality: lifeguard HAB obs
Barb Kirkpatrick	MOTE	Co-PI; New Provider	*No activity in Year 1*	O&M for new provider—beach quality; lifeguard HAB obs
Gary Jeffress	TAMU-CC	Co-PI; TCOON Water level Local Data Node	Maintain TCOON local data node with server enhancement (Texas water level network)	O&M for TCOON stations enabling expansion of water level network outside of Texas
Nancy Rabalais	LUMCON	Co-PI; LUMCOM Stations and Local Data Node	Maintain LUMCON Local Data Node's environmental monitoring stations off Louisiana	O&M for existing DO observations in out years; Add DO sensor east of Mississippi River Delta
James E. Ivey	FL FWRI	Co-PI; New Provider	*No activity in Year 1*	New data provider; O&M to retain biochemical, HAB stations on West FL Shelf
Jan van Smirren[4]	Fugro-Geos	Co-PI; New Provider	*No activity in Year 1*	HFR station: Phase 1 - pilot in TX

Table 1. Key Personnel and Project Roles by GCOOS Subsystem
(continued)

Key Investigator	Institution	Project Role	Base Activity Year 1	Upcoming Year = Base + Enhancements
Modeling and Analysis Subsystem				
Paul A. Montagna	TAMU-CC	Co-PI; Ecosystem modeling task	Ecosystem model: tools for decision-makers	Workshop on ecosystem model tools for decision-makers; support funds for senior personnel
Frank Muller-Karger[5]	USF	Co-PI; Ocean Color RS provider	Maintain IMaRS local data node: one satellite product	Enhanced satellite products provided
Robert Leben	CCAR at CU	Co-PI; SSH RS provider	New satellite provider: sea surface height product	Improved product availability
Nan Walker	LSU	Co-PI; SST RS provider	Maintain ESL local data node: one satellite product	Additional satellite products provided
Outreach and Education Subsystem				
Chris Simoniello	IMMS	Co-PI, GCOOS Outreach and Education Coordinator	O/E Coordinator work; O/E workshop for satellite product providers	O/E for additional interactive kiosks (2-3); O/E additional workshops for data providers (2-3); O/E workshops for Educators (3)
Sharon Walker	IMMS	Co-PI; Education and Outreach	O/E workshop for satellite product providers	O/E for additional interactive kiosks (2-3); O/E additional workshops for data providers (2-3); O/E workshops for Educators (3)

Notes:
1 – replacing Vembu Subramanian who took another position
2 – replacing Loren Coen who took another position
3 – replacing Greg Stone who died
4 – replacing Pak T. Leung who took another position
5 – replacing Chuanmin Hu who took another position

ACOE=U.S. Army Corps of Engineers; Bowhead=Bowhead Science and Technology LLC; CBI=Conrad Blutcher Institute; CCAR=Colorado Center for Astrodynamics Research, University of Colorado; DISL=Dauphin Island Sea Laboratory; FSU=Florida State University; Fugro=Fugro-GEOS, Inc.; FWRI=Florida Fish & Wildlife Research Inst.; HRI=Harte Research Institute; IMMS=Institute for Marine Mammal Studies; LSU=Louisiana State University; LUMCON=Louisiana Universities Marine Consortium; MOTE=Mote Marine Laboratory; SCCF=Sanibel-Captiva Conservation Foundation; TAMU=Texas A&M University; TAMU-CC=Texas A&M Univ.-Corpus Christi; UAH=University of Alabama-Huntsville; USF=University of South Florida; USM=University of Southern Mississippi

IMPACT AND APPLICATIONS

National Security

The project will result in the rapid availability of new data sets for use by the U.S. Coast Guard in its Search and Rescue operations. In particular, the building of the High Frequency Radar network will reduce the search area, resulting in better outcomes for many SAR events. Additionally, when the High Frequency Radar network is built, it may provide data that can be used to track ships.

Economic Development

Integration of existing and new observing elements into a unified ocean observing system will provide easy access to data, products, and services needed by users in their desired formats. Impacts of this system will enable the private sector to more easily generate new product lines. It will employ workers at technically skilled levels, such as for equipment manufacture, deployment, operation and

maintenance, and data processing and analysis. For example, the project is providing O&M support to keep operational the observing system that measures surface currents over the shelf in the Mississippi-Alabama-Florida panhandle region. This system was used to track movement of oil at the surface from the BP *Deepwater Horizon* oil spill in 2010. The GCOOS will provide information that can be used to promote tourism by providing up-to-date information on beach, boating, and similar conditions; and, through the integration and linkage of people and resources, provide society the capability to better predict and mitigate against coastal hazards (e.g., track pollutants from industrial spills or enhance planning response for storm surge and coastal inundation), manage commercially important marine resources (e.g., wind energy, fisheries), and facilitate safe and efficient marine transportation.

Quality of Life

The potential future impact of the project is that the GCOOS itself will be built, and this will provide data and information that can be used to assess quality of life issues related to the marine environment. Through integration of the multi-disciplinary data and information obtained from diverse sources, monitoring to preserve and restore healthy marine ecosystems will advance (e.g., monitor and suggest how to mitigate low oxygen conditions on the shelf and in the coastal estuaries) and protecting human health will be benefited (e.g., improve prediction of water quality including harmful algal blooms). Improved capabilities to detect and predict climate variability will result from long time series of data that will allow better decisions on actions to adapt to, mitigate, or prevent the consequences. The sharing of the data, models, and products via the internet is for the common benefit of the public and all participants, including industry, NGOs, academia, and federal, state, regional, and local government agencies.

Science Education and Communication

Through the outreach and education activities of this project, more information will be available to the public, in forms suitable for diverse intellectual abilities, to help them make informed decisions regarding a broad range of interactions with the coastal ocean environment—from recreational activities to emergency responses.

TRANSITIONS

National Security

High frequency radar data are used by the U.S. Coast Guard to narrow the search radius during Search and Rescue operations. Non-federal data sets have been made available for immediate ingestion into weather forecast models and use in planning emergency response actions.

Economic Development

Web-based access to a wide range of data and information has been made available to recreational boaters, including sports fishermen and tourists, to improve planning for leisure time.

Quality of Life

Efforts are underway to improve water quality monitoring and to integrate data sets for more effective decision-making by local, state, and federal agencies. They currently are focused primarily on issues of hypoxia, excessive nutrient loading and eutrophication, harmful algal blooms, and beach conditions.

Science Education and Communication

Materials and lesson plans are planned for completion to provide educators with new tools and information to educate their classes in the marine ecosystem. Plans are in development to expand the

GCOOS interactive learning kiosks for installation in informal educational settings such as aquariums and museums.

RELATED PROJECTS

The Gulf of Mexico Coastal Ocean Observing System (GCOOS) was formed in 2000 as one of the regional coastal ocean observing systems under the U.S. Integrated Ocean Observing System (IOOS). GCOOS is developing as a sustained ocean observing system that provides data, information, and products on marine and estuarine systems to a wide range of users. A Regional Association, GCOOS-RA, was established by Memorandum of Agreement (MoA) in January 2005. The organizational structure was in place by April 2006. Much progress has been made toward the development of the GCOOS. However, as revealed by the BP *Deepwater Horizon* oil spill, which is a vivid example of the need for a robust ocean observing system in the Gulf of Mexico, much remains to be done to bring this observing system to maturity.

Projects that have supported GCOOS development to date are in four main areas: Regional Association Governance and Management, Data Management, Observations, and Modeling. All areas include components of Outreach and Education in them, and all are represented on the GCOOS web site at *http://gcoos.org*. The foundational projects for each of these areas are:

Regional Association Governance and Management: Projects that developed the GCOOS Regional Association, its structure, and priorities, as well as provided staff and travel support for the GCOOS-RA efforts.

1. Maintenance and Enhancement of the Gulf of Mexico Coastal Ocean Observing System-Regional Association. Awarded $1,199,943 by NOAA, Cooperative Agreement NA08NOS4730289, 1 May 2008 through 30 April 2012. Principal Investigators: A.E. Jochens and W.D Nowlin, Jr.
2. Development of the Gulf of Mexico Coastal Ocean Observing System (GCOOS) and its Regional Association (GCOOS-RA): Phase II. Awarded $1,100,688 by NOAA, Cooperative Agreement NA05NOS4731167, 1 June 2005 through 31 May 2008. Principal Investigator: W.D. Nowlin, Jr. A.E. Jochens was a named key person on this project and was the Regional Coordinator for GCOOS-RA.

Data Management: Projects that support common data management and regional interoperability.

3. Maintenance and Enhancement of the GCOOS Data Portal; Building toward a Regional Operations Center. Awarded $1,700,000 by NOAA, Cooperative Agreement NA08NOS4730411, 1 January 2009 through 31 December 2011. Principal Investigators: A.E. Jochens, M.K. Howard, F. Gayanilo, S.H. Walker, and C. Simoniello.
4. Integration of and Regional Enhancement to the GCOOS: Development of a Data Portal. Awarded $500,000 by NOAA, Cooperative Agreement NA07NOS4730217, 1 January 2008 through 30 April 2010. Principal Investigators: A.E. Jochens and M.K. Howard.
5. GCOOS Services to the Gulf of Mexico Research Initiative (GoMRI): Awarded $315,250 for the first three years of the contract period 1 June 2011 through 31 May 2016. Years 4 and 5 will be priced when the scope of work to be carried out in those years is decided. Principal Investigators: M.K. Howard and A.E. Jochens.

Note: #6 below also has elements of Data Management.

Observations: Projects that support entrainment of non-federal local data nodes into the GCOOS and that promote data interoperability using IOOS standards and protocols.

6. Standardization of Local Data Network Nodes in the Gulf of Mexico. Awarded $744,038 by NOAA, Cooperative Agreement NA07NOS4730199, 1 January 2008 through 31 December 2011. Principal Investigators: A.E. Jochens and M.K. Howard.

Note: #3 and 4 above also have elements of entraining non-federal data nodes into GCOOS.

Modeling: Projects that support regional modeling and analysis capacity building.

7. GOMEX 3-D Operational Ocean Forecast System Pilot Project. Subcontract with Portland State University for $200,000 for the period 11 March 2010 through 10 September 2011. Principal Investigators: M.K. Howard, A.E. Jochens, and S.F. DiMarco.
8. SURA contract for $28,921 for the period 1 June 2010 through 31 December 2011. Principal Investigator: M.K. Howard.